

A COMPACT ELLIPTICAL INFRARED LIGHT UNIT FOR A MOTOR VEHICLE

FIELD OF THE INVENTION

The present invention relates to light units for motor vehicles of the type including a filter which is opaque to visible radiation but transparent to infrared radiation. The term "light unit" is to be understood to mean a headlight or other device for providing illumination.

BACKGROUND OF THE INVENTION

Such light units are known which are in addition arranged to enable the filter to be displaced between an active position and a retracted position. The front face of these light units has a large surface area, which is a disadvantage.

DISCUSSION OF THE INVENTION

The object of the present invention is to mitigate this disadvantage, that is to say to propose a light unit with a movable infrared filter, but which also has a reduced front surface area.

According to the invention, a light unit for a motor vehicle comprising a light source, a reflector with two focal regions and a lens, the light source being placed in one of the two focal regions so as to produce a pool of reflected light in the other focal region, and the lens being arranged to convert this pool of light into a beam projected on the road, is characterised in that the light unit comprises, between the reflector and lens, a filter which is opaque to visible light and transparent to infrared radiation, the filter being movable between a position spaced away from the light passing from the reflector to the

lens, and a position in which a substantial part of the light passing from the reflector to the lens goes through the filter.

According to various preferred but optional features of the invention, which may be taken individually or in any technically possible
5 combination:

- the light unit includes a member for holding the filter, which is adapted to deform under the effect of thermal deformation of the filter;
- the light source is placed in the internal focal region of the reflector,
10 and in that the filter is placed downstream of the pool of reflected light;
- the filter holding means are arranged to permit displacement of the filter to a position in which it is substantially in a shadow zone corresponding to the optical image of a lamp hole in the reflector;
- 15 - the light unit includes a filter holding means for carrying the filter, the filter holding means being arranged to allow displacement of the filter to a position in which it extends, by its surface, along an edge of the light flux;
- such a filter holding means is provided and consists of means for
20 rotating the filter;
- the filter rotating means comprise a pivot having an axis situated downstream of the active position of the filter in the direction of propagation of the light;

- the filter has in its active position a location and an extent which are so chosen that the filter allows some light radiation to pass from the reflector to the lens without passing through the filter;
- the lens defines zones which are arranged to disorganize a light flux,
5 the said zones being located in the path of rays passing from the reflector to the lens without passing through the filter;
- the said disorganizing zones are annular regions on the lens.

Further features and advantages of the invention will appear more clearly on a reading of the following detailed description of some
10 preferred embodiments of the invention, which is given by way of non-limiting example only and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a view, in vertical cross section, of a motor vehicle light
15 unit in the form of a headlight according to the invention, in which the filter is shown in an active position.

Figure 2 is a vertical cross section of the same light unit with the filter retracted.

Figure 3 is a vertical cross section of a light unit according to the
20 invention in which the filter is mounted for horizontal straight line motion transverse to the radiated light.

Figure 4 is a vertical cross section of a light unit according to the invention in which the filter is mounted for horizontal straight line movement parallel to the radiated light.

Figure 5 is a vertical cross section of a light unit according to the invention in which the filter is mounted for rotation about a horizontal axis parallel to the direction of the radiated light.

Figure 6 is a vertical cross section of a headlight according to the invention in which the filter is mounted for rotation about a vertical axis transverse to the direction of the radiated light.

Figure 7 is a vertical cross section of a headlight according to the invention in which the axis is so located that the filter bounds the internal path of the light when it is retracted.

Figure 8 is a vertical cross section of a light unit according to the invention in which the filter is mounted for rotation about a horizontal axis transverse to the direction of the radiated light.

Figure 9 is a vertical cross section of a light unit according to the invention which includes a lens for diffusing rays which have passed from the reflector to the lens without going through the activated filter.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

The general structure of the light units shown in Figures 1 to 9 includes a reflector 100 of the ellipsoidal or so-called elliptical type, with an internal focus 110 and an external focus 120, a lens 200, the focus of which is coincident with the external focus 120 of the reflector 100, and a light source 105 which is located on the internal focus 110 of the reflector 100.

Ellipsoidal surfaces are typically surfaces which are defined mathematically from two focal zones which will be called here the foci 110 and 120, but which in practice are not true points but have a

slight extent in at least one dimension. This extent embraces the filament of the light source in the case of the internal focal zone 110, and it forms a pool of light in the case of the external focal zone 120. The mathematically defined surface is therefore an approximate
5 ellipsoid.

The rays emitted by the source after being reflected on the elliptical reflector 100 increase in the vicinity of the external focus 120. The light rays arriving on the lens 200 therefore seem to be emitted by a light source of small dimensions located at the focus 120. The rays
10 are then projected in front of the vehicle, to form a beam in which the light distribution is appropriate for the "main beam" function of the headlight.

As can be seen in Figures 1 to 9, a movable filter 300 of small dimensions is in an active position in which it is placed in the vicinity
15 of the external focus 120 of the reflector, so that it intercepts substantially all of the light radiation due to the concentration of the rays at this location. In this example the filter 300 is located downstream of the external focus 120, though it could be disposed upstream or exactly at the external focus 120, with reference to the
20 path of the light rays. Thus positioned, the filter 300 intercepts nearly all of the light which is propagated from the reflector 100 to the lens 200, while being positioned in a zone of large volume as compared with the size of the filter itself. It is thus easily possible to position improved holding and displacement means in this zone.

25 Having regard to the general geometry of the light unit, the positioning of the filter in the vicinity of the external focus 120 also enables the filter 300 to have positions which are close to the active position and

which do not interfere with any light radiation, so that as a result they can be adopted as inactive positions of the filter 300.

In this example the filter 300 consists of a small square plate. It is located at right angles to the main projection axis.

5 Figures 1 and 2 show a first embodiment of this arrangement, in which the filter 300 is movable in vertical straight line movement in the direction y. In this version, the filter 300 can be guided on a rail 400 which is indicated in the Figure by a phantom line. It may for example be driven by an electric motor or an electromagnet.

10 The filter 300 is preferably lodged within a frame (not shown) made of a flexible material, for example sheet metal. This frame is deformable under the effect of deformations of the filter without damaging the filter. In another version, the filter 300 is held by means of suitable elastic return means, which extend or bend under the effect of
15 deformations of the filter 300.

In a further version indicated in Figure 3, the straight line movement of the filter may take place in a horizontal direction Z which is also transverse to the main direction of propagation.

In Figure 4, the filter 300 is mounted for straight line movement on a
20 rail parallel to the main direction of propagation. In its effaced position, the filter is far enough in advance of the external focus 100 to interfere only slightly with the light.

In this connection, elliptical projectors typically produce a shadow cone 150 which corresponds to the hole in the base of the reflector in
25 which the lamp is held. This hole, which is therefore occupied by the non-reflective lamp base components, is the cause of what is

effectively an absence of light radiation within the cone, which typically surrounds the main propagation axis. The cone 150 generally defines an aperture of small angle. However, the dimensions of the filter 300, disposed in this way, are particularly small, and the filter is
 5 put virtually entirely into the interior of this cone by simply displacing the filter towards the wide end of the cone 150.

In another embodiment shown in Figures 5 and 6, the filter 100 is rotatable about a horizontal axis. In Figure 5, the axis of rotation is parallel to the main direction of propagation of the light. In Figure 6,
 10 the axis y1 is transverse to the propagation direction above the light flux.

The axis of rotation y1 extends simply along one edge of the filter, so that the latter is effaced on the side of the light radiation, which is particularly concentrated in the vicinity of the focus 120.

15 In the embodiment shown in Figure 7, the axis of rotation y2 is horizontal and in front of the active position of the filter. Figure 7 shows the path of the light between the second focus 120 and the lens 200. The light describes at this position a cone 250, the apex of which is at the second focus 120, with the wide end, or base, of the
 20 cone being on the periphery of the lens 200. The axis y2 is placed sufficiently in front of the active position of the filter 300 for a rotation through about 60° to be enough for the filter 300 to be brought out of the cone of light 250.

More precisely, the axis y2 is however close enough to the filter 300
 25 for the filter 300 to be close to the boundary of the cone 250, parallel to its conical envelope.

More generally, such retracting movement which puts the filter into a position directly bounding the flux of internal light is found to be at the same time very effective in optical terms, and is particularly satisfactory in terms of size, because the direct bounding of the cone
 5 of light is found to be a very advantageous working zone for the filter 300 because its extent and thickness are most suitable.

Reference is now made to Figure 8, in which the axis of rotation y3 is vertical and is offset in front of the active position of the filter. The means for displacing the filter cause the latter to rotate through 180°,
 10 so that the filter, when retracted, is not only rotated but is also displaced forward until it is placed within the shadow cone 150 mentioned above.

The axis y3 is for example located transversely to the centre of the radiated light, at the intersection with the main axis of the light
 15 radiated by the light unit. Thus, between the active and inactive positions the filter seems simply to have been moved in a straight line.

The invention does of course extend to any type of motion of the filter, that is to say using any degrees of freedom, for example rotation about any one of three main axes of rotation and/or straight line
 20 movement along any one of these three axes.

Figure 9, to which reference is now made, shows a filter 300 placed slightly downstream of the external focal zone 120. In this arrangement, the filter 300 has an extent and a position such that it does not intersect all of the light. Some of the rays travel to the lens
 25 300 by passing outside the edges of the filter 300. These rays rejoin the lens 200 at the periphery of the latter. Such rays are used in order to produce in front of the vehicle a slight amount of illumination in

visible light (ordinary light) which swallows up any parasitic red tinge due to the presence of the filter 300.

To accentuate visibility of the white light thus formed in the peripheral zone of the lens, without dazzling drivers travelling in the opposite
5 direction, an arrangement is adopted in this annular peripheral zone of the lens 300 which is adapted to accentuate diffusion of the light, that is to say to disorganize the rays (i.e. with a lantern effect).

For example, the lens may have in this zone unpolished glass or a slight frosting. Thus, diffusion of the white light elements at the
10 periphery of the lens produces lateral photometry of the lantern type which gives these light units a white appearance, without however (preferably) having high intensity on the axis. In this way, steady lighting can be obtained which is close to the maximum authorised for a lantern (60 candela), or of the so-called "day running light" type.

15 More generally, arrangements are preferably adopted in which control of leakage of white light out of the filter is arranged, and these leakages are preferably diffused on leaving the light unit. In this way, the use of a white lantern constituted by a second light source is avoided.